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## Individual Well-Being in a Dynamic Perspective

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**Conchita D'Ambrosio  
Joachim R. Frick**

**Individual Well-Being in a Dynamic Perspective**

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# Individual Well-Being in a Dynamic Perspective\*

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## Abstract

This paper explores the determinants of individual well-being as measured by self-reported levels of satisfaction with income. Making full use of the panel data nature of the German Socio-Economic Panel, we provide empirical evidence for well-being depending on absolute and on relative levels of income in a dynamic framework. This finding holds after controlling for other influential factors in a multivariate setting. The main novelty of the paper is the consideration of dynamic aspects: the individual's own history as well as the relative income performance with respect to the others living in the society under analysis do play a major role in the assessment of well-being.

*Journal of Economic Literature* Classification No.: D63, I31, D31.

**Keywords:** Interdependent Preferences, Inequality Aversion, Status, Subjective Well-Being, SOEP.

# 1 Introduction

A vast literature in the social sciences has shown that individual well-being depends on what we see around us. As such, there is a relative notion according to which we compare ourselves to neighbors, colleagues, more generally, to a reference group, and it matters where we perceive ourselves in the social hierarchy. Social status of an individual plays, indeed, an important role in the determination of well-being. Though most economists are sympathetic to the idea that individual well-being depends on relative standing, traditional modelling has been reluctant to incorporate status considerations directly into the analysis. Only in recent years have models been developed to describe the evidence of these phenomena, to represent the preferences of individuals who care about their relative standing and to examine their behavioral implications (see Section 2 for a review).

In this paper we propose a new functional form to represent *interdependence of preferences* over income distributions, that is, an individual's preferences that depend jointly on the entire distribution of income, and use data from Germany over the period 1990 to 2004 to test its validity. Our idea is the following: well-being of an individual as measured by the degree of personal satisfaction with respect to own income depends at time  $t$  on four components. i) The *absolute component*, that is, the standard of living of the individual at time  $t$ ; ii) the *relative component*, that is, the income of the individual compared to that of others at the same time  $t$ . Both components have a *dynamic* counterpart: iii) the *absolute dynamic component*, that is, how the individual performed in terms of own income from time  $t - 1$  to time  $t$ ; iv) the *relative dynamic component*, that is, how the individual performed from  $t - 1$  to  $t$  with respect to others' incomes.

The absolute component is standard in all economics modelling: utility of income should depend directly on own material well-being. The relative component is present in various models of interdependent preferences assuming alternative formulations such as rank, relative income, per capita income, overall mean income, and sum of the income gaps with respect to richer and poorer individuals. With interdependency, utility of income depends not only on one's own material well-being (the absolute component) but also on one's relative standing in society. The dynamic components aim at capturing the effects of history, both of the individual and of others. One's own history is clearly relevant to one's well-being, because personal history is a major determinant of aspiration levels. We hypothesize that the history of others will also have an impact on one's well-being, above and beyond one's relative standing in society. Specifically, well-being depends not only on one's ranking in society in the past and at present. It can also depend on the

situation of other individuals populating the income curve: if another individual, who used to be behind in terms of income, succeeded in moving ahead, one's well-being might be affected differently as compared to a situation in which the income ordering has been preserved. An individual concerned with status might be particularly satisfied if he was able to pass others and might show disappointment with his income if others were able to pass him, in a way that will not be captured by his relative status in past and present income distributions. This sentiment, captured by the *relative dynamic component*, is in addition to that embedded in the absolute and relative components of well-being: somebody who earns a lot at time  $t$  and is higher up in the income scale at time  $t$  might still show disappointment if others were able to pass him and he was not able to pass anyone. The *absolute dynamic component*, on the other hand, focuses on own history distinguishing between individuals experiencing an income growth from those on a decreasing income path. Only an increase in income is expected to have a positive effect on income satisfaction. To the best of our knowledge, these dynamic components have not appeared in the literature before and represent the novelty of our approach.

The role of an individual's history in measuring well-being is contained also in Gilboa and Schmeidler (2001) but with a different perspective from the present contribution. Their setting is more similar to habit formation (Pollak, 1970) than to the dynamic components here introduced. "The individual's own history of payoffs affects her aspirations. For instance, when an individual is accustomed to a certain standard of living, her well-being depends mostly on deviations from it." (Gilboa and Schmeidler, 2001, p.270; see also p.276 for a discussion.) Well-being then depends on the instantaneous payoff defined as the difference between the objective payoff and the individual's aspiration. In this paper, deviations from a certain standard of living are contained in the *absolute dynamic component* while the *relative dynamic component* models explicitly the passing of or being passed by others. The role of histories of others in measuring well-being, on the other hand, appeared in Hirschman (1973), labeled as the *tunnel effect*.<sup>1</sup> "Suppose that the individual has very little information about his future income, but at some point a few of his relatives, neighbors, or acquaintances improve their economic or social position. Now he has something to go on: expecting that his turn will come in due course, he will draw

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<sup>1</sup> "Suppose I drive through a two-lane tunnel, both lanes going in the same direction, and run into a serious traffic jam. No car moves in either lane as far as I can see (...). I am in the left lane and feel dejected. After a while the cars in the right lane begin to move. Naturally, my spirits lift considerably, for I know that the jam has been broken and that my lane's turn to move will surely come any moment now. Even though I still sit still, I feel much better off than before because of the expectation that I shall soon be on the move." (Hirschman, 1973, p.545.)

gratification from advances of others—for a while.” (Hirschman, 1973, p.546.) In the latter contribution, though, the temporal aspect of the concept of history is somehow lost when advances of others are simply considered as the presence of richer individuals, giving rise to inequality in the present distribution of income. In our opinion, advances of similar individuals are better captured by the *relative dynamic component* we propose.

Our paper is related to several strands of the economics literature. First, we contribute to the literature on happiness by providing an explanation of the ‘happiness and income paradox’, that is, the significant but quite “modest”<sup>2</sup> positive bivariate relationship found between happiness and income, as reported by Easterlin (2001). This relationship, as Easterlin (2001) wrote, “is further weakened by the introduction of controls of other variables, such as unemployment and education.” Our results show that the utility of Germans depends heavily on their relative standing in the society. Second, there is a link to the experimental literature.<sup>3</sup> The utility function that we propose is a generalization of that introduced by Fehr and Schmidt (1999). Our results might shed light on the eventual presence of inequality-aversion in a competitive market, where as opposed to a laboratory, a whole society is involved. Third, our approach provides new insights regarding the distribution of incomes. We test relative deprivation and satisfaction as proposed by Yitzhaki (1979), Hey and Lambert (1980), Chakravarty (1997) among others, and the passing phenomenon introduced by Bossert and D’Ambrosio (2007).

After a review of the theoretical literature on interdependence of preferences and on the measurement of relative deprivation and satisfaction, we introduce the new functional form to represent interdependent preferences over income distributions in a dynamic setting (Section 2). The employed data and estimation methods are described in Section 3. Section 4 contains the application to Germany over the period 1990 to 2004. Section 5 concludes. Descriptive statistics of the data employed are reported in the Appendix.

## 2 Theoretical Background

### 2.1 Interdependent Preferences

Interdependent preferences, that is, preferences that depend directly on the situation of others, were modelled formally for the first time in the theory of consumer’s demand. The

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<sup>2</sup>The simple correlation between happiness and income in the United States, 1994 data, for example, is only 0.20, as shown by Easterlin (2001, p.468).

<sup>3</sup>See Fehr and Schmidt (2003) for an extensive survey.



phenomenon that utility functions depend on other people’s consumption is known as the *relative income hypothesis* (Duesenberry, 1949), differentiating further between *keeping up with the Joneses* where preferences depend on current consumption, and *catching up with the Joneses* where preferences depend on lagged consumption. Leibenstein (1950) was the first to introduce demand functions that explicitly took into account the desire to be ‘in style’, the bandwagon and snob effects, as well as conspicuous consumption. Since then the literature has advanced to a high level of sophistication exploring the implications of such preferences on the theory of asset pricing (Abel, 1990, Campbell and Cochrane, 1999, Galí, 1994), on Pareto optimality (Collard, 1975, and Shall, 1972), on the theory of optimal taxation (Boskin and Sheshinski, 1978, Dupor and Liu, 2003, Ljungqvist and Uhlig, 2000, and Abel, 2005), on the determination of work hours (Bowles and Park, 2005), on public spending (Ng, 1987), and on the allocation of resources (Fershtman and Weiss, 1993). In varying formulations, with preferences defined over general consumption goods or on an individual’s identity, the theory modelled social interactions.<sup>4</sup> Robson (1992) investigates the implications of including status directly in utility functions defined over wealth on attitudes to risk, and Corneo and Jeanne (2001) and Konrad (1992) perform an analogous exercise with respect to growth rates. Similarly, Frank (1984) examines the role of interdependent preferences on wage determination in a model where preferences are defined over wage distributions.

There are alternative approaches that do not incorporate concerns for relative standing directly into utility functions. These models, in the presence of market imperfections, are able to generate them endogenously “as ‘instrumental’, in reduced form utility functions, while maintaining the standard economic modelling methodology based on optimizing individuals who have stable preferences over the goods and services they and their children consume” (Postlewaite, 1998, p.784). Within this framework, questions such as how concern for relative standing can influence savings and growth rates have been investigated (Cole, Mailath and Postlewaite, 1992, and Corneo and Jeanne, 1998).

Another group of contributions offer plausible explanations of the emergence of interdependent preferences and concern for status. Samuelson (2004) and Sethi and Somanathan (2001), for example, provide evolutionary explanations of the phenomenon. Bisin and Verdier (1998), on the other hand, attribute the formation of such preferences to the intergenerational transmission of cultural traits. Others (Bester and Güth, 1997,

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<sup>4</sup>See Becker (1974) and Becker and Stigler (1977) for the first group, Akerlof and Kranton (2000) for the second. Sobel (2005) provides an interesting discussion on similarities and differences between the two strands of the literature.

Fershtman and Weiss, 1998, Koçkesen, Ok and Sethi, 2000, for example) examine the circumstances under which evolution would lead to the survival of individuals with interdependent preferences.

Experimentalists make use of interdependence in preferences to explain the behavior of subjects that repeatedly violate the game theoretical predictions.<sup>5</sup> Alternative specifications of utility functions were proposed, and the most relevant for the present contribution is that of Fehr and Schmidt (1999) that we report in detail below.

We now describe our model formally. There is a fixed set  $N = \{1, \dots, n\}$  of  $n \geq 2$  individuals and their incomes are recorded in an income distribution  $x = (x_1, \dots, x_n) \in \mathbb{R}_+^n$ , where  $\mathbb{R}_+^n$  is the set of  $n$ -dimensional vectors with non-negative components. We indicate the mean of  $x$  by  $\lambda(x)$ . For  $x \in \mathbb{R}_+^n$ ,  $B_i(x) = \{j \in N \mid x_j > x_i\}$  is the set of individuals with a higher income than  $i$ ; similarly,  $W_i(x) = \{j \in N \mid x_j < x_i\}$  is the set of individuals with a lower income than  $i$ . The utility function of individual  $i$ ,  $i = 1, \dots, n$ , proposed by Fehr and Schmidt (1999) is:

$$U_i(x) = x_i + \alpha \frac{\sum_{j \in B_i(x)} (x_j - x_i)}{n} + \beta \frac{\sum_{j \in W_i(x)} (x_i - x_j)}{n}, \quad (1)$$

where  $\alpha \leq \beta \leq 0$ . The utility of each individual depends positively on own income and negatively both on *disadvantageous inequality* (the second term in (1)) and *advantageous inequality* (the third term in (1)). According to Fehr and Schmidt, individuals dislike inequitable distributions. “They experience inequity if they are worse off in material terms than the other players in the experiment, and they also feel inequity if they are better off. (...) (H)owever, we assume that, in general, subjects suffer more from inequity that is to their material disadvantage than from inequity that is to their material advantage.” (Fehr and Schmidt, 1999, p.822.)

Axiomatic characterizations of this utility function have been provided by Neilson (2006) and Sandbu (2005). Only few other studies have provided axiomatic bases for interdependent preferences, among which Ok and Koçkesen (2000) axiomatized the relative income hypothesis, Neilson and Stowe (2005) preferences depending on the rank of other individuals, Karni and Safra (2002) preferences with moral value judgement, and Segal and Sobel (2006) preferences influenced by the behavior of others.

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<sup>5</sup>For extensive surveys see Fehr and Schmidt (2003) and Sobel (2005).

## 2.2 The Measurement of Deprivation and Satisfaction

In the income distribution literature, relative standing plays its most significant role in the measurement of *deprivation* and *satisfaction*. The definition of relative deprivation adopted is the following: “We can roughly say that [a person] is relatively deprived of X when (i) he does not have X; (ii) he sees some other person or persons, which may include himself at some previous or expected time, as having X, (iii) he wants X, and (iv) he sees it as feasible that he should have X” (Runciman, 1966, p.10). When considering income as the object of relative deprivation, absolute individual deprivation is simply the sum of the gaps between an individual’s income and the incomes of all individuals richer than him, while in the relative case, the income gaps are normalized by mean income. Formally, Yitzhaki (1979) and Hey and Lambert (1980) specify the deprivation felt by a person with income  $x_i$  with respect to a person with income  $x_j$  as:

$$\bar{d}_i(x) = \begin{cases} (x_j - x_i) & \text{if } x_i < x_j \\ 0 & \text{else} \end{cases}, \quad (2)$$

while the deprivation function of the person with income  $x_i$  is:

$$\bar{D}_i(x) = \frac{\sum_{j \in B_i(x)} (x_j - x_i)}{n}. \quad (3)$$

Following this early literature, Chakravarty (1997) proposes to look at a relative concept of deprivation felt by a person with income  $x_i$  with respect to a person with income  $x_j$ , namely, their income share differential  $\frac{\bar{d}_i(x)}{\lambda(x)}$ . Now, the total relative deprivation function of the person with income  $x_i$  is:

$$D_i(x) = \frac{\sum_{j \in B_i(x)} (x_j - x_i)}{n\lambda(x)}. \quad (4)$$

When the comparison is conducted with respect to poorer individuals, we obtain the relative satisfaction function of the person with income  $x_i$ ,  $S_i(x)$ . The function  $S_i(x)$  is

$$S_i(x) = \frac{\sum_{j \in W_i(x)} (x_i - x_j)}{n\lambda(x)}. \quad (5)$$

In the income distribution literature it is implicitly assumed that well-being of an individual depends negatively on deprivation and positively on satisfaction.<sup>6</sup> Deprivation and satisfaction are very similar to the concepts of disadvantageous and advantageous

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<sup>6</sup> “If people have no reason to expect or hope for more than they can achieve, they will be less discontent with what they have, or even grateful simply to be able to hold on to it. But if, on the other hand, they

inequality of Fehr and Schmidt's (1999) utility function. If we believe that the normalization of the income gaps should take into account not only the dimension of the society but also mean income then equation (1) could be rewritten as:

$$U_i(x) = x_i + \alpha D_i(x) + \beta S_i(x). \quad (6)$$

This normalization could be more appropriate when comparing different time periods, as is the case for the present contribution.

In this setting, Bossert and D'Ambrosio (2007) introduce time as an additional dimension in the determination of the level of deprivation felt by an individual. They suggest that a person's feeling of relative deprivation today depends on a comparison with those who are better off today but there is an additional determinant: the feeling of deprivation relative to a person with a higher income is more pronounced if this person was *not* better off yesterday, that is, he has passed the individual under consideration when moving from yesterday's distribution to today's. Relative deprivation of an individual in this framework is determined by the interaction of two components, namely, the average gap between the individual's income and the incomes of all individuals richer than him (the traditional way of measuring individual deprivation), and a function of the number of people who were ranked below or equal in the previous-period distribution but who are above the person under consideration in the current distribution. Similar considerations can be made when measuring relative satisfaction, with the latter increasing in the number of people passed when going from yesterday to today.

### 2.3 A Dynamic-Status-Concerned Utility Function

In a similar spirit, concerns for an individual's own and relative history could be incorporated in the utility function. A two-period income distribution is a vector

$$(x^{t-1}, x^t) = ((x_1^{t-1}, \dots, x_n^{t-1}), (x_1^t, \dots, x_n^t)) \in \mathbb{R}_+^{2n},$$

where  $x^{t-1}$  is the income distribution of the previous period and  $x^t$  that of the current period. Indicating by  $B_i^- = B_i(x^t) \cap B_i(x^{t-1})$  the set of individuals that currently have and previously had an income higher than  $i$ , by  $B_i^+ = B_i(x^t) \setminus B_i(x^{t-1})$  the set of individuals that have but did not have an income higher than  $i$ , by  $W_i^- = W_i(x^t) \cap W_i(x^{t-1})$  the

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have been led to see as a possible goal the relative prosperity of some more fortunate community with which they can directly compare themselves, then they will remain discontent with their lot until they have succeeded in catching up" (Runciman, 1966, p.9).

set of individuals that have and had an income lower than  $i$ , by  $W_i^+ = W_i(x^t) \setminus W_i(x^{t-1})$  the set of individuals that have but did not have an income lower than  $i$ , we propose the following functional form of a utility function with concerns for relative standing in a dynamic framework:

$$U_i^t(x^{t-1}, x^t) = \underbrace{\tau x_i^{t-1}}_{\text{i) Abs.}} + \underbrace{\vartheta \frac{x_i^t - x_i^{t-1}}{x_i^{t-1}}}_{\text{ii) Abs.Dyn.}} + \underbrace{\kappa \frac{\sum_{j \in B_i^-(x^t)} (x_j^t - x_i^t)}{n\lambda(x^t)} + \chi \frac{\sum_{j \in W_i^-(x^t)} (x_i^t - x_j^t)}{n\lambda(x^t)}}_{\text{iii) Rel.}} + \underbrace{\varepsilon \frac{\sum_{j \in B_i^+(x^t)} (x_j^t - x_i^t)}{n\lambda(x^t)} + \eta \frac{\sum_{j \in W_i^+(x^t)} (x_i^t - x_j^t)}{n\lambda(x^t)}}_{\text{iv) Rel.Dyn.}}, \quad (7)$$

where  $\tau, \vartheta, \kappa, \chi, \varepsilon, \eta$  are parameters indicating the weight on the individual's utility of alternative income specifications. The well-being of an individual depends at time  $t$  on four components. i) The *absolute component*, that is, the standard of living of the individual at time  $t$ . We take as its proxy the level of income experienced in the previous period, that is the income level the person was used to. ii) The *absolute dynamic component* aims at capturing own income's history and is incorporated as own income percentage change. With interdependencies, individual well-being depends on relative standing. In the setting of this paper, the individual takes into account not only his position in the income scale (such as the rank) but also distances in incomes distinguishing between richer and poorer individuals. We follow Runciman's suggestion in this comparison and assume that: "The magnitude of a relative deprivation is the extent of the difference between the desired situation and that of the person desiring it" (Runciman, 1966, p.10). An individual compares himself to others and the intensity of his deprivation and satisfaction feelings depends directly on distances in incomes. To incorporate individuals' histories we separate the relative income performance in two components distinguishing those that are and were ahead or behind the individual under analysis, depending on the comparison being made with respect to richer or poorer individuals, from those that experienced a change in the relative rankings. As such iii) the *relative component* measures the relative income gaps at the same time  $t$  between the individual and the others that are and were ahead or behind, depending on the side of the distribution considered; iv) the *relative dynamic component*, on the other hand, captures how individual  $i$  performed from time  $t - 1$  to time  $t$  with respect to others' incomes. It is based on the relative income gaps at the same time  $t$  of the individual income and that of the others that are and were not ahead or behind the individual considered, that is, those that have passed or have

been passed in going from yesterday to today. It is with this component that we model Hirschman's "advances of others".

The following effects of alternative income specifications on individual utility are to be expected:

1. The absolute component has a positive contribution on satisfaction with own income, hence  $\tau > 0$ ;
2. the absolute dynamic component has a positive effect on satisfaction with own income only when positive, that is, when the individual experiences an income growth, otherwise it should be non positive, hence  $\vartheta > 0$ ;
3. satisfaction with income should depend positively on relative satisfaction and negatively on relative deprivation according to the income distribution literature, hence according to this interpretation  $\kappa < 0$  and  $\chi > 0$ ; on the other hand, Fehr and Schmidt (1999) report that individuals dislike inequitable distributions, hence in view of this  $\kappa < 0$  and  $\chi < 0$ , with  $\kappa \leq \chi < 0$ . We do not commit at this stage to any of the theories and let our result show which of the two fits better the German society. The same considerations hold for the parameters of the relative dynamic component:  $\varepsilon < 0$  and  $\eta > 0$  for the theories belonging to the income distribution literature; according to Fehr and Schmidt we expect  $\varepsilon < 0$  and  $\eta < 0$ , with  $\varepsilon \leq \eta < 0$ . Alternatively, when being passed is seen as good auspice for the own future income prospect, hence Hirschman's tunnel effect does exist,  $\varepsilon > 0$ ;<sup>7</sup>
4. satisfaction with passing and disappointment with being passed for a given distribution of income at time  $t$  should be captured by the relative intensity of the two parts of the relative component and the relative dynamic component. When individuals feel more deprived (or 'suffer' according to Fehr and Schmidt's theory) with respect to those who passed them from time  $t - 1$  to time  $t$ , we should observe  $|\varepsilon| > |\kappa|$ , similarly,  $\eta > \chi$  for individuals who feel more satisfied if they were able to pass others;
5. if own income history plays a role in the sentiment experienced when passed or being passed, then the parameters of the relative dynamic component  $\varepsilon$  and  $\eta$  could differ

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<sup>7</sup>On this issue Hirschman (1973, p.559) writes: "(...) changes in the income of B lead to changes in A's welfare not only because A's relative position in the income scale has changed, but also because changes in B's fortunes will affect A's prediction of his own future income. (...) B advances, and this leads A to predict an improvement in his own position as well."

between those experiencing an income growth and those on a decreasing income path. Individuals could feel differently with respect to others depending on own history: an individual earning more today than yesterday could not experience any negative feeling with respect to those that were able to pass him – he is a winner and could be sympathetic to other winners. In addition, seeing other individuals doing better than him today could be a signal of the level of mobility existing in the society. The individual may think that he could be one of them tomorrow and interpret the being passed as a good auspice. In this sense, Hirschman’s tunnel effect could be driven only by winners.

To sum up, the signs of the parameters should be:  $\tau > 0$ ,  $\vartheta > 0$ ,  $\kappa < 0$  and  $\chi > 0$ , or  $\kappa < 0$  and  $\chi < 0$ , with  $\kappa \leq \chi < 0$ ,  $\varepsilon < 0$  and  $\eta > 0$ , or  $\varepsilon < 0$  and  $\eta < 0$ , with  $\varepsilon \leq \eta < 0$ , or  $\varepsilon > 0$ ,  $|\varepsilon| > |\kappa|$ , and,  $\eta > \chi$ .

### 3 The Data and Methods

Generally, an individual’s well-being is measured in microdata by interviewing people in surveys using a single-occasion, self-report question. Papers on this subject make use of both cross-sectional data (e.g. Eurobarometer Surveys, United States’ General Social Survey), and panel data (e.g. the German Socio-Economic Panel, the British Household Panel Survey, the Russian Longitudinal Monitoring Survey and the European Community Household Panel). Panel data are mandatory to test the effect of the individual’s own and relative to others’ history on well-being. In addition panel data allows to control for otherwise unobserved individual characteristics. This is especially important if these unobservables are systematically correlated with reported well-being. In particular, the dataset used in the paper is the German Socio-Economic Panel (SOEP, see below). Our measure of the individual’s well-being, i.e. ‘satisfaction with income’ is measured on an 11-point scale, ranging from 0 (‘completely dissatisfied’) to 10 (‘completely satisfied’).

Landua (1991) argues that there is evidence of panel effects concerning these satisfaction scales, i.e. respondents tend to use these scales differently after ‘getting used’ to them (especially there is a tendency away from the extreme values such as ‘10’). This will have to be considered when interpreting the changes in satisfaction over the first waves of a panel. Frick, Goebel, Schechtman, Wagner, and Yitzhaki (2006) confirm this finding for more recent waves of SOEP data providing evidence for learning effects on behalf of the respondents with respect to satisfaction as well as income.

The German Socio-Economic Panel (SOEP) is an ongoing panel survey with a yearly re-interview design (see <http://www.diw.de/gsoep>). The starting sample in 1984 was almost 6,000 households based on a random multi-stage sampling design. A sample of about 2,200 East German households was added in June 1990, half a year after the fall of the Berlin wall. This gives a very good picture of the GDR society on the eve of the German currency, social and economic unification which happened on July 1, 1990. In 1994/95 an additional subsample of 500 immigrant households was included to capture the massive influx of immigrants since the late 1980s. Finally, in 1998 and 2000 two more random samples were added which increased the overall number of interviewed households in 2000 to about 13,000 with approximately 24,000 individuals aged 17 and over.

The data used in this analysis covers the period 1990 (the first data available for the East German sample) to 2004. Due to the above mentioned learning effects, we exclude wave 1 of the more recently started sub-samples. Our overall sample is pooling all adult respondents with valid information on income and subjective satisfaction, leaving us with approximately 160,100 observations based on 26,600 individuals in East and West Germany.

The income measure we investigate is monthly net household income. This so-called ‘income screener’ is supposed to give a measure of the more regular income components received by all household members at the time of the interview. This variable might be an inferior measure of economic well-being when compared to annual income since it tends to neglect certain irregular income components (like Christmas bonuses, annual bonuses, etc.) but it certainly fits better to our time-dependent measures of well-being.<sup>8</sup> In addition the interviews are conducted during the first months of the year and, by that time, yearly income cannot be known to the household yet. In order to compare income over time, all income measures are deflated to 2000 prices, also accounting for purchasing power differences between East and West Germany. In order to control for differences in household size and the economies of scale, we apply an equivalence scale with an elasticity of 0.5, given by the square root of household size. Descriptive statistics (see the Appendix) are based on weighted data correcting for design differences in sampling probabilities and selective non response after wave one.

Given the ordinal nature of the dependent variable on well-being an appropriate regression model would be an ordered probit. In order to make full use of the panel nature of our data, controlling for otherwise unobserved individual characteristics and potentially

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<sup>8</sup>Bivariate correlation for annual income (based on previous year income) and well-being is considerably lower than the one with respect to monthly income, the values being .32 as opposed to .36.



different use of the underlying satisfaction scale (running from 0 to 10) across individuals, we should apply a fixed effects estimator. Unfortunately, such a fixed-effects ordered probit estimator does not exist in standard statistical software packages. As an approximation, however, we make use of a fixed-effects regression model, assuming linearity (see also Hamermesh, 2001, Schwarze and Haerpfer, 2007, and Ferrer-i-Carbonell and Frijters, 2004). We also run a random-effects model in order to investigate the effects of time invariant control variables, such as gender and migration status.

## 4 The Results

Applied papers relevant to the analysis presented here include D'Ambrosio and Frick (2007) with an empirical implementation of relative deprivation and its effects on well-being. A vast quantity of papers, on the other hand, have estimated models of interdependence of preferences even if these contributions often appeared disconnected from the theoretical literature surveyed in Section 2. The majority of applied studies on subjective assessments and happiness are more rooted in the psychological and sociological literature than in economics when motivating their studies.<sup>9</sup> Among those only a few, to the best of our knowledge, deal with variables and data similar to those of the present contribution, which uses genuine panel data and self-declared satisfaction with income.<sup>10</sup> These include Burchardt (2005) who investigates the process of adaptation to falling and rising incomes and the effect of expectations based on the first ten waves of the British Household Panel Survey. Burchardt shows that changes in objective circumstances influence satisfaction with income. Chan, Ofstedal and Hermalin (2002) model change in perceived adequacy of income in terms of actual change in income and other relevant factors based on two-wave panel data for Singapore and Taiwan. It is shown that there is a strong relationship between the two. Ravallion and Lokshin (2001) base their analysis on two-wave panel data for Russia and conclude that income and its changes have much power in explaining perceived well-being. Our paper differs for the introduction of dynamic components, that, to the best of our knowledge, have not appeared in the literature before and represent the novelty of our approach. Wunder and Schwarze (2006) does not belong to the previous group since the variable of interest is job satisfaction, but the application is based on the same dataset we use, SOEP, and the relative income components of the utility function

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<sup>9</sup>See Easterlin (2002), and Frey and Stutzer (2002) for an extensive survey on happiness.

<sup>10</sup>More often the variable of interest is self declared satisfaction with overall life or job satisfaction and the data are cross-sectional.

of each worker are those proposed by Fehr and Schmidt (1999), see equation (1). In this contribution, it is a utility function depending positively on disadvantageous inequality to be interpreted as the presence of Hirschman’s tunnel effect. We believe that our extension with dynamic components is better suited for this aim since advances of similar individuals are better captured by the *relative dynamic component* we propose. In other words, advances are, by definition, produced by actual movements and are not just comparisons within a static concept. In addition, the separation of the relative income performance with respect to richer individuals in two components distinguishing those that are and were ahead the individual under analysis from those that experienced a change in the relative rankings allows for the joint presence of a negative and positive effect of disadvantageous inequality, the former being captured by the *relative component*, the latter by the *relative dynamic component* (which is indeed what our results show, see below).

At the heart of interdependence in preferences are comparisons that take place among members of the same reference group. The identification of the appropriate ones is a very difficult, since normative, task. It could even be possible that the same individual has different reference groups, one for each variable of interest (see Runciman, 1966, Ch.2 for a clear discussion of this issue). In this paper we decided to inspect three alternatives and assume that individuals compare themselves nationwide (first reference group), to those living in the same federal state (second reference group) or to peers with the same level of education (third reference group). The second reference group aims at capturing the local dimension in the comparison. Unfortunately, the dataset we have access to does not have sufficient observations to run the analysis at a neighborhood, say, the postal code level. The third reference group is more linked to merit and returns to investments in human capital. As a control for our results being not driven by the choice of the three reference groups we also decided to allocate individuals at random to eight groups. This random grouping takes into account potential clustering effects arising from the initial sampling procedure followed when collecting the data and makes sure that individuals from the same primary sampling unit do not belong to the same random group. Descriptive results at the level of the nationwide reference group are given in the Appendix.

In the following multivariate regression models, we control for sex, age (age squared), marital status, immigration status, residency in East or West Germany, education, household composition, homeownership (as a proxy for household wealth) and unemployment.<sup>11</sup>

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<sup>11</sup>This unemployment index is calculated at the aggregate household level, relating the number of months in registered unemployment over the previous year to the number of months with potential employment of all adult household members.

In the fixed-effect specification by definition the time independent variables sex and immigration status are dropped from the estimation. In order to control for potential panel or learning effects, we also include a dummy variable identifying individuals with 3 and more interviews as a proxy for the interviewing experience in the panel. In order to capture the effect of the state of the economy, we include regional unemployment rates at the federal state level. The variables of the relative and relative dynamic components were topcoded at the 99<sup>th</sup> percentile of each year and reference group to reduce the impact of outliers.

For each reference group, we estimate two models where in the second specification we allow the parameters of the relative and relative dynamic components to vary depending on the individual experiencing an income growth or being on a decreasing income path.

Results on the fixed-effects estimators are given in Table 1 (for the first model) and 2 (for the second model). The personal control variables yield in principle the expected results: becoming better educated and getting married and those who live together with dependent children in the household tend to be more satisfied. East Germans are less satisfied with their income. Becoming an homeowner is negatively related to income satisfaction, indicating that net of income effects, homeowners have higher income aspirations due to increased housing costs induced by their mortgage repayments. The experience of unemployment within an individual's household has the expected detrimental effect on well-being. The institutional control variable on regional unemployment rate is not significant in almost all specifications once controlling for the individual labor market success.

More important to our research question appear to be the coefficients of the alternative income components: absolute, relative, and their dynamic counterparts. The absolute component of income has always the expected positive and significant effect on individual's well-being: a given sum of money has significant explanatory power for income satisfaction. The absolute dynamic component has the expected signs, positive for those experiencing an income growth, negative otherwise. Regarding the relative component, results are in favour of the theories belonging to the income distribution literature: Germans are satisfied with respect to poorer individuals and feel deprived when compared to richer ones. In all models the feeling of satisfaction (REL.DYN. Satisfaction in Table 1) is higher with respect to poorer individuals they were able to pass from time  $t - 1$  to time  $t$ , that is individuals who were richer at time  $t - 1$  and poorer in  $t$ , as opposed to that felt with respect to individuals who have always been richer (REL. Satisfaction in Table 1). For deprivation, on the other hand, it depends on the specification considered: the coefficient on the relative dynamic part is negative only when the comparison takes place

at the federal state level and, when significant, it is always lower than the corresponding coefficient in the relative component. When we distinguish at the federal state level between those experiencing an income growth from those losing income (results reported in Table 2), we observe that this result is driven by individuals losing income since the coefficient is not significant for the gainers. Germans, who lose income, do feel deprived with respect to those who were able to pass them, but this sentiment of deprivation is lower than the one they experience when compared to individuals who have always been richer than them. For the other reference groups, when no distinction is made between those experiencing an income growth and those losing income (results reported in Table 1), the coefficient of the relative dynamic deprivation component is positive, and in absolute value lower than the corresponding coefficient in the relative component: Germans do not prove any feeling of deprivation with respect to individuals who have passed them, actually, being passed makes them more satisfied with their income. Being passed is seen as good auspice for future gains, thus our findings support Hirschman's (1973) tunnel effect. When distinguishing, as in Table 2, between those experiencing an income growth and those losing income, we conclude that this result is driven by those gaining income since the coefficient is insignificant for those on a decreasing income path.

The random-effects models show that women are more satisfied than men, and native born persons are more satisfied than immigrants, in all models. However, due to below average income position of migrants in Germany, the latter effect is somewhat reduced once we introduce income.<sup>12</sup>

## 5 Conclusion

Are we satisfied with income? The answer to the opening question of this paper is that people's satisfaction depends on what they observe around them and on the income histories of themselves and the others. Analyzing data for Germany from 1990 to 2004 we showed that individual well-being, measured by perceived income satisfaction, is, indeed, a function of absolute, relative and dynamic components.

The separation of the relative income performance with respect to richer individuals in two components—distinguishing those that are and were ahead the individual under analysis, considered in the *relative component* of deprivation, from those that experi-

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<sup>12</sup>Breusch and Pagan Lagrangian multiplier tests led to conclude that the appropriate specification of the models is the fixed-effects one. The results from the random effects models are available upon request to the authors.

enced a change in the relative rankings, included in the *relative dynamic component* of deprivation—has the advantage of reconciling two views that were, so far, considered in opposition in the literature.<sup>13</sup> An individual’s well-being is negatively affected by the comparison with permanently richer individuals, a standard result in studies on relative income.<sup>14</sup> At the same time, the presence of newly richer individuals plays the informational role described in Hirschman’s tunnel effect for individuals on an increasing income path. This finding for an advanced economy such as Germany is new and somehow unexpected given that the predictions of the literature were in favor of its presence only in early stage of economic development or more volatile societies. Our results show that the tunnel effect does play a major role in the assessment of individual well-being in stable societies, such as today’s Germany.

## 6 Appendix: Descriptive Results

Information given in this appendix relates to the nationwide level only. The corresponding data on the various absolute, relative and dynamic measures for the regional, educational and random reference groups do not show a relevant degree of variation—all those are available from the authors upon request.

Table A1 provides simple descriptive statistics on dependent and independent variables included in the multivariate analyses as given in Tables 1 and 2, respectively. Pairwise correlations are depicted in Table A2: Satisfaction with income (YSAT) is positively related to absolute income as well as to income changes (our absolute, dynamic term). With respect to the relative and the relative dynamic measures we find statistically significant correlations in both directions, negative for relative deprivation and positive for relative satisfaction. Figure A1 gives the marginal distribution for the dependent variable on “Satisfaction with income (YSAT)” in the pooled dataset for 1992 to 2004. Controlling for eventual changes of this distribution across time, Figure A2 reveals that—at least with respect to “satisfaction with income”—Germany appears to be a rather stable society since the early 1990s. Finally, Figure A3 presents the distribution of the differences of “Satisfaction with income” over the period  $[t - 1, t]$ , again pooled over the whole period under investigation indicating a very symmetric picture, i.e., in the society as a whole, satisfaction with income appears to change in similar way to the good as well as to the bad.

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<sup>13</sup>See on this point Hirschman (1973) and Senik (2004), among others.

<sup>14</sup>See, for example, Clark and Oswald (1996).

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## Tables and Figures:

**Table 1: Correlates of income satisfaction in Germany 1990-2004 - Results from fixed effects models.**

	(1a) Nationwide	(2a) Federal State	(3a) Education	(4a) Random
	<b>Income Satisfaction</b>			
Age	-0.050** (0.005)	-0.049** (0.005)	-0.052** (0.005)	-0.051** (0.005)
Age squared	0.003** (0.000)	0.003** (0.000)	0.003** (0.000)	0.003** (0.000)
East	-0.359** (0.072)	-0.504** (0.072)	-0.395** (0.072)	-0.358** (0.072)
Years of education	0.002 (0.006)	0.002 (0.006)	0.044** (0.006)	0.002 (0.006)
# of children in HH	0.127** (0.009)	0.123** (0.009)	0.127** (0.009)	0.127** (0.009)
Homeowner	-0.039* (0.019)	-0.036+ (0.019)	-0.032+ (0.019)	-0.040* (0.019)
Unemployment index	-0.006** (0.000)	-0.007** (0.000)	-0.007** (0.000)	-0.006** (0.000)
Married	0.171** (0.021)	0.170** (0.021)	0.171** (0.021)	0.172** (0.021)
3 or more interviews	0.018 (0.028)	0.015 (0.028)	0.011 (0.028)	0.018 (0.028)
Unemployment Rate	0.004 (0.005)	0.007 (0.005)	0.009* (0.005)	0.004 (0.005)
ABS: Income of the previous year	0.342** (0.018)	0.366** (0.018)	0.390** (0.018)	0.347** (0.018)
ABS. DYN.: Positive % change	0.001** (0.000)	0.002** (0.000)	0.002** (0.000)	0.001** (0.000)
ABS. DYN.: Negative % change	-0.015** (0.001)	-0.012** (0.001)	-0.016** (0.001)	-0.015** (0.001)
REL.: Deprivation	-2.539** (0.063)	-2.292** (0.060)	-2.372** (0.060)	-2.506** (0.062)
REL. DYN.: Deprivation	0.836** (0.301)	-0.995** (0.260)	0.647* (0.271)	0.666* (0.285)
REL.: Satisfaction	0.204** (0.032)	0.261** (0.034)	0.110** (0.033)	0.206** (0.032)
REL. DYN.: Satisfaction	0.676** (0.247)	0.408+ (0.232)	0.767** (0.225)	0.714** (0.245)
Constant	7.612** (0.123)	7.510** (0.123)	7.210** (0.123)	7.611** (0.123)
Observations	160182	160182	160182	160182
Individuals	26323	26323	26323	26323
R-squared	0.08	0.08	0.08	0.08
+ significant at 10%; * significant at 5%; ** significant at 1%. (Standard errors in parentheses). Additional control variables include dummies for year of observation.				

Source: Authors' calculation from SOEP.

**Table 2: Correlates of income satisfaction in Germany 1990-2004 - Results from fixed effects models.**

	(1b) Nationwide	(2b) Federal State	(3b) Education	(4b) Random
Income Satisfaction				
Age	-0.049** (0.005)	-0.049** (0.005)	-0.052** (0.005)	-0.050** (0.005)
Age squared	0.003** (0.000)	0.003** (0.000)	0.003** (0.000)	0.003** (0.000)
East	-0.342** (0.072)	-0.494** (0.072)	-0.384** (0.072)	-0.350** (0.072)
Years of education	0.002 (0.006)	0.002 (0.006)	0.045** (0.006)	0.002 (0.006)
# of children in HH	0.128** (0.009)	0.124** (0.009)	0.127** (0.009)	0.127** (0.009)
Homeowner	-0.040* (0.019)	-0.037* (0.019)	-0.033+ (0.019)	-0.040* (0.019)
Unemployment Index	-0.006** (0.000)	-0.007** (0.000)	-0.007** (0.000)	-0.006** (0.000)
Married	0.172** (0.021)	0.170** (0.021)	0.171** (0.021)	0.172** (0.021)
3 or more interviews	0.017 (0.028)	0.015 (0.028)	0.011 (0.028)	0.017 (0.028)
Unemployment Rate	0.003 (0.005)	0.006 (0.005)	0.008+ (0.005)	0.004 (0.005)
ABS: Income of the previous year	0.352** (0.019)	0.380** (0.019)	0.398** (0.018)	0.356** (0.019)
ABS. DYN.: Positive % change	0.003** (0.000)	0.002** (0.000)	0.003** (0.000)	0.002** (0.000)
ABS. DYN.: Negative % change	-0.014** (0.001)	-0.012** (0.001)	-0.015** (0.001)	-0.014** (0.001)
REL: Deprivation for positive % change	-2.623** (0.070)	-2.338** (0.067)	-2.461** (0.068)	-2.547** (0.069)
REL. DYN: Deprivation for positive % change	9.930** (1.368)	-0.495 (0.798)	5.131** (1.030)	3.144** (0.912)
REL: Satisfaction for positive % change	0.189** (0.033)	0.249** (0.035)	0.095** (0.034)	0.199** (0.033)
REL. DYN: Satisfaction for positive % change	0.431+ (0.254)	0.269 (0.237)	0.540* (0.231)	0.569* (0.250)
REL: Deprivation for negative % change	-2.481** (0.064)	-2.272** (0.061)	-2.328** (0.062)	-2.483** (0.063)
REL. DYN: Deprivation for negative % change	0.493 (0.308)	-1.139** (0.272)	0.378 (0.279)	0.370 (0.297)
REL.: Satisfaction for negative % change	0.168** (0.044)	0.186** (0.046)	0.074 (0.045)	0.158** (0.043)
REL. DYN: Satisfaction for negative % change	11.042** (1.763)	3.580** (1.301)	5.469** (1.356)	6.079** (1.497)
Constant	7.497** (0.124)	7.494** (0.123)	7.149** (0.125)	7.575** (0.124)
Observations	160182	160182	160182	160182
Individuals	26323	26323	26323	26323
R-squared	0.08	0.08	0.08	0.08

+ significant at 10%; \* significant at 5%; \*\* significant at 1%. (Standard errors in parentheses).  
Additional control variables include dummies for year of observation.

Source: Authors' calculation from SOEP.

**Table A1: Descriptive statistics of variables used in multivariate analyses.**

<b>Variable</b>	<b>Mean (Std.dev.)</b>
Satisfaction with income	6.180 (2.221)
Age	46.11 (16.53)
Age squared	239.9 (164.8)
East	.284 (.451)
Years of education	11.73 (2.48)
# of children in HH	.579 (.919)
Homeowner	.444 (.497)
Unemployment index (HH)	8.34 (21.63)
Married	.657 (.474)
3 or more interviews	.972 (.162)
Unemployment Rate (Region)	11.69 (4.63)
ABS: Income of the previous year	1.362 (.668)
ABS DYN.: Positive % change	11.18 (21.54)
ABS DYN.: Negative % change	6.86 (12.48)
REL: Deprivation	.217 (.188)
REL DYN: Deprivation	.018 (.028)
REL: Satisfaction	.205 (.322)
REL DYN: Satisfaction	.017 (.031)
REL: Deprivation for positive % change	.100 (.158)
REL DYN: Deprivation for positive % change	.003 (.005)
REL: Satisfaction for positive % change	.120 (.275)
REL DYN: Satisfaction for positive % change	.015 (.032)
REL: Deprivation for negative % change	.116 (.184)
REL DYN: Deprivation for negative % change	.015 (.029)
REL: Satisfaction for negative % change	.085 (.219)
REL DYN: Satisfaction for negative % change	.002 (.004)

Source: Authors' calculations from SOEP.

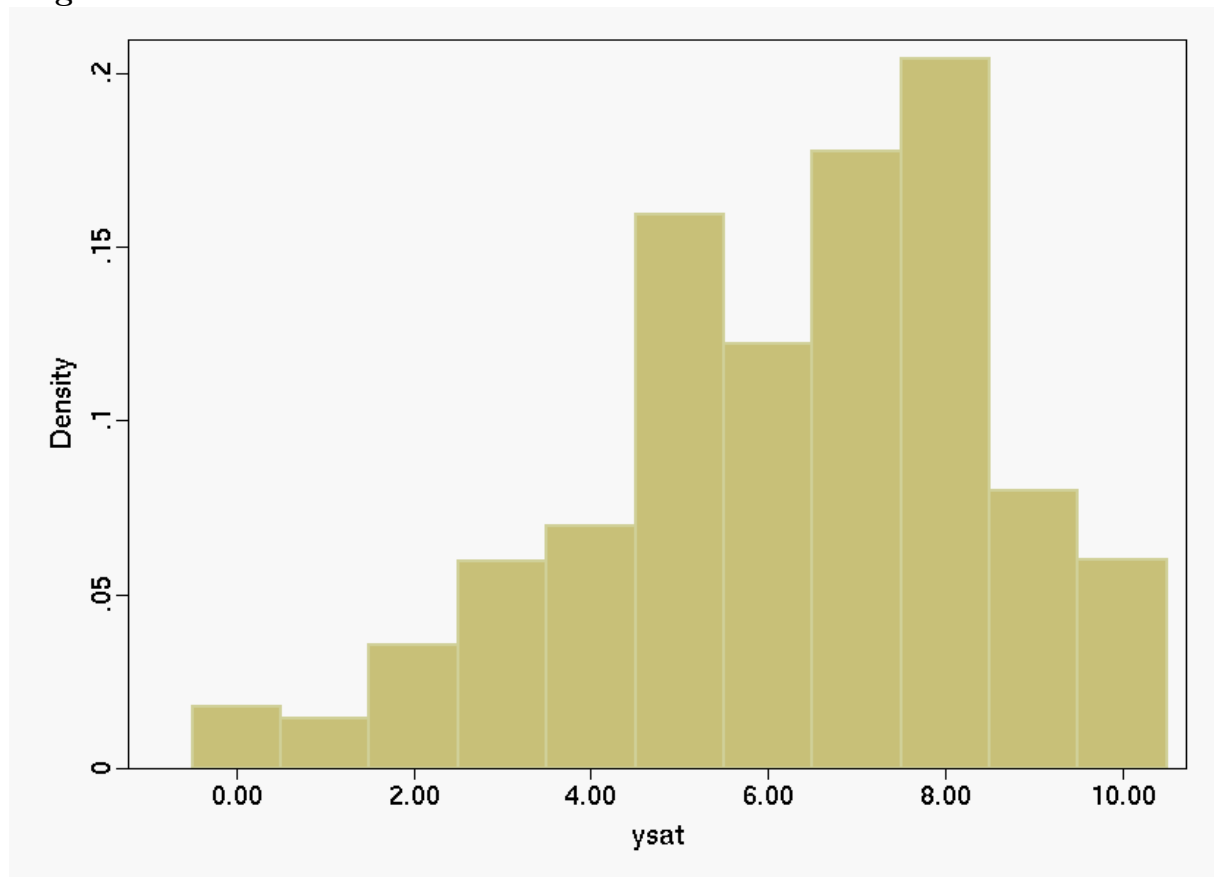
**Table A2: Pairwise correlation: satisfaction with income.**

	Satisfaction with income (YSAT)	Income of the previous year (absolute)	% Change in income since previous year (absolute dynamic)	Relative Deprivation	Relative Deprivation, dynamic	Relative Satisfaction
Income of the previous year (absolute)	0.3247*					
% Change in income since previous year (absolute dynamic)	0.0649*	-0.2590*				
Relative Deprivation	-0.3496*	-0.5486*	-0.1110*			
Relative Deprivation, dynamic	-0.0819*	0.1427*	-0.5779*	0.2569*		
Relative Satisfaction	0.3125*	0.7022*	0.0880*	-0.4092*	-0.0536*	
Relative Satisfaction, dynamic	0.0858*	-0.1119*	0.7188*	-0.0663*	-0.1989*	0.2259*

• significant at 5%

Source: Authors' calculations from SOEP.

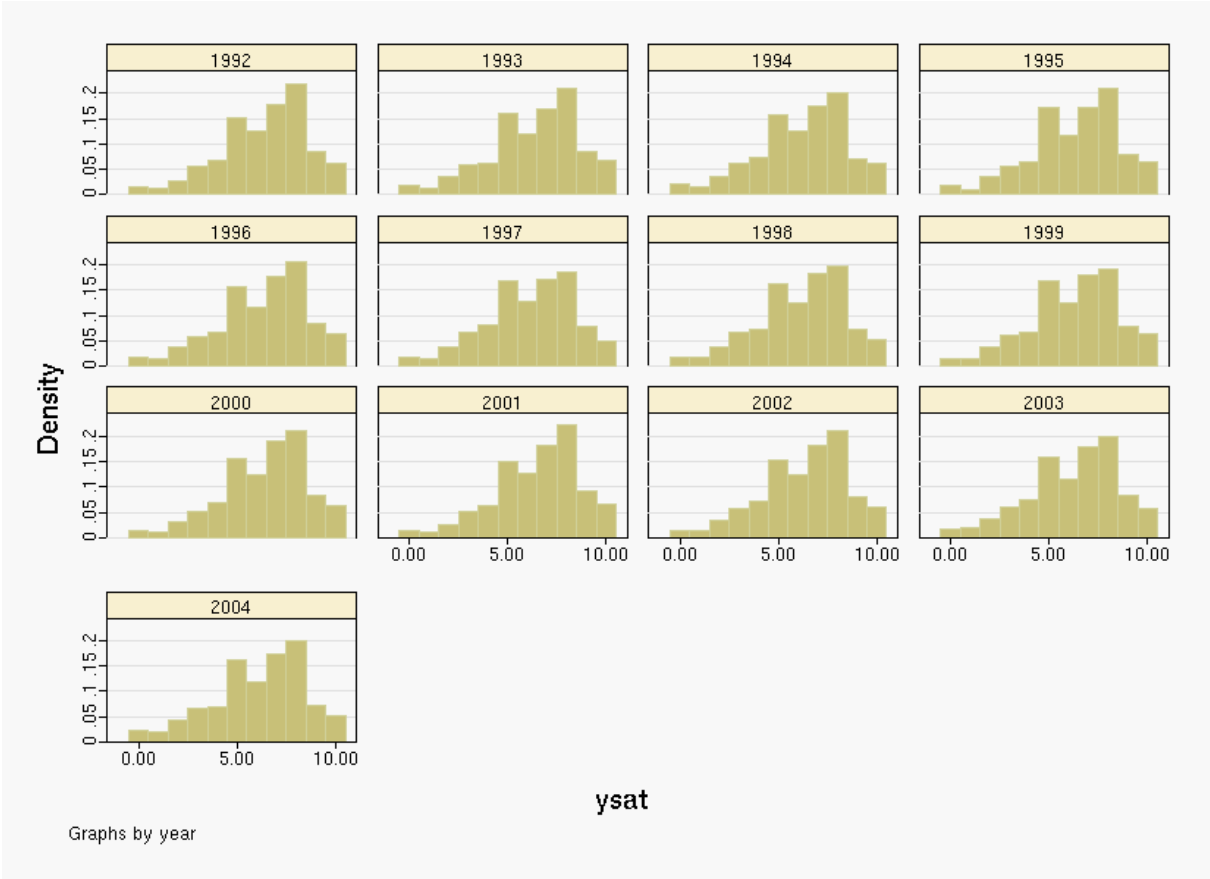
**Figure A1: Satisfaction with income.**



Satisfaction is measured on a 11-point scale from 0=completely dissatisfied to 10=completely satisfied.

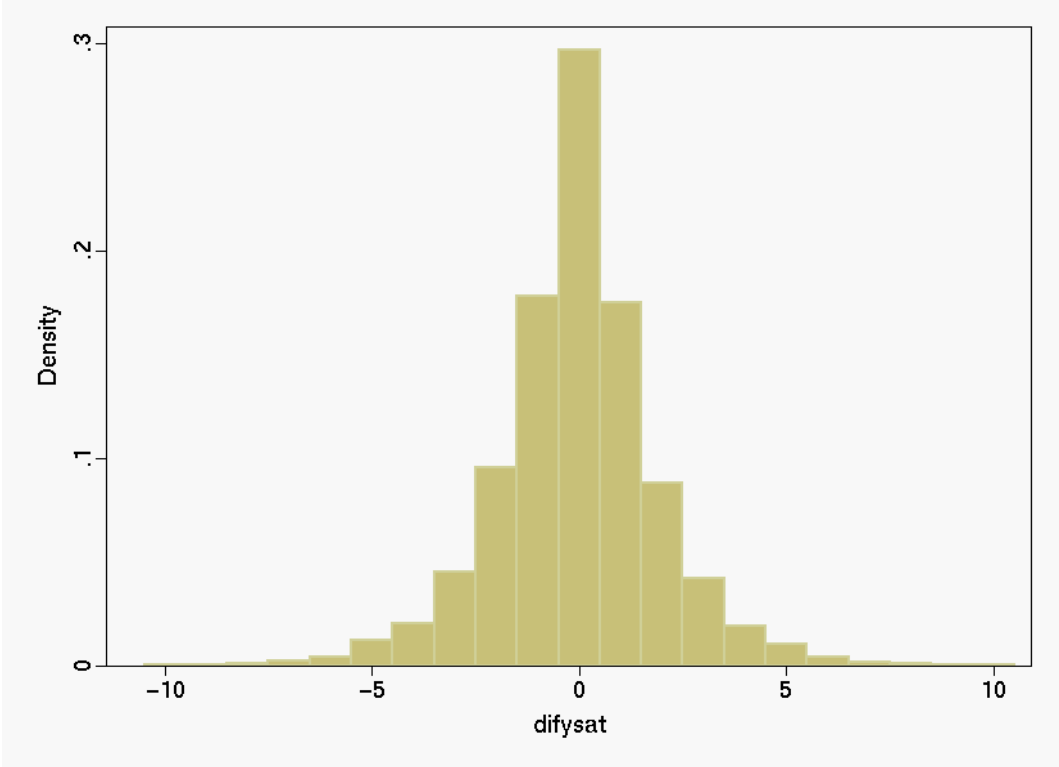
Source: Authors' calculations from SOEP.

Figure A2: Time series on satisfaction with income.



Source: Authors' calculations from SOEP.

Figure A3: Difference in satisfaction with income over the period [t-1,t].



Source: Authors' calculations from SOEP.